This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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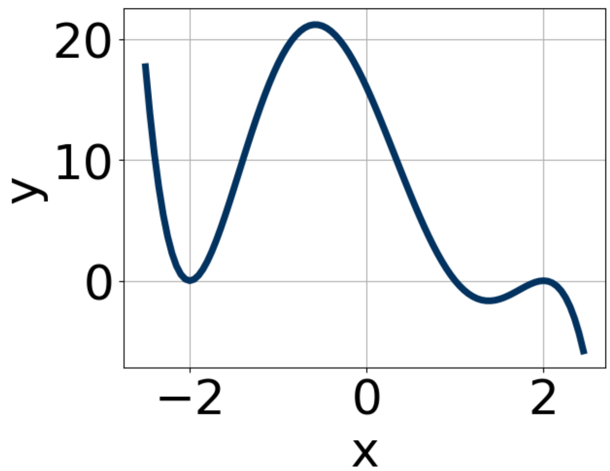
1. Which of the following equations *could* be of the graph presented below?



The solution is $-6(x-2)^{10}(x+2)^4(x-1)^7$, which is option D.

A. $-13(x-2)^{10}(x+2)^5(x-1)^{10}$

The factor $(x+2)$ should have an even power and the factor $(x-1)$ should have an odd power.

B. $-14(x-2)^{10}(x+2)^9(x-1)^{11}$

The factor $(x+2)$ should have an even power.

C. $18(x-2)^{10}(x+2)^4(x-1)^{10}$

The factor $(x-1)$ should have an odd power and the leading coefficient should be the opposite sign.

D. $-6(x-2)^{10}(x+2)^4(x-1)^7$

* This is the correct option.

E. $16(x-2)^8(x+2)^8(x-1)^5$

This corresponds to the leading coefficient being the opposite value than it should be.

General Comment: General Comments: Draw the x-axis to determine which zeros are touching (and so have even multiplicity) or cross (and have odd multiplicity).

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2. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $ax^3 + bx^2 + cx + d$.

$$\frac{-3}{5}, \frac{7}{4}, \text{ and } \frac{1}{3}$$

The solution is $60x^3 - 89x^2 - 40x + 21$, which is option B.

A. $a \in [53, 63], b \in [-91, -78], c \in [-46, -37],$ and $d \in [-21, -18]$

$60x^3 - 89x^2 - 40x - 21$, which corresponds to multiplying everything correctly except the constant term.

B. $a \in [53, 63], b \in [-91, -78], c \in [-46, -37],$ and $d \in [20, 23]$

* $60x^3 - 89x^2 - 40x + 21$, which is the correct option.

C. $a \in [53, 63], b \in [83, 95], c \in [-46, -37],$ and $d \in [-21, -18]$

$60x^3 + 89x^2 - 40x - 21$, which corresponds to multiplying out $(5x - 3)(4x + 7)(3x + 1)$.

D. $a \in [53, 63], b \in [49, 51], c \in [-88, -79],$ and $d \in [20, 23]$

$60x^3 + 49x^2 - 86x + 21$, which corresponds to multiplying out $(5x - 3)(4x + 7)(3x - 1)$.

E. $a \in [53, 63], b \in [-165, -159], c \in [107, 112],$ and $d \in [-21, -18]$

$60x^3 - 161x^2 + 110x - 21$, which corresponds to multiplying out $(5x - 3)(4x - 7)(3x - 1)$.

General Comment: To construct the lowest-degree polynomial, you want to multiply out $(5x + 3)(4x - 7)(3x - 1)$

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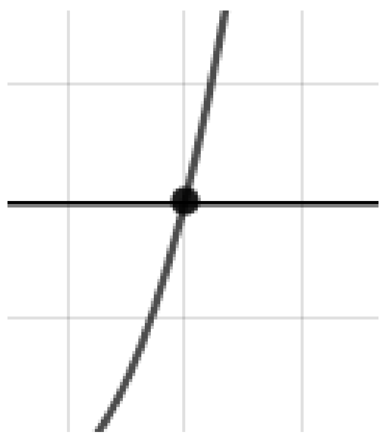
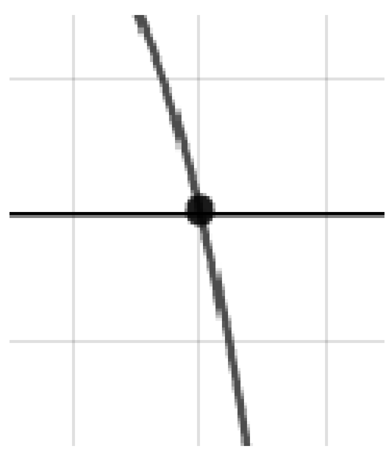
3. Describe the zero behavior of the zero $x = 8$ of the polynomial below.

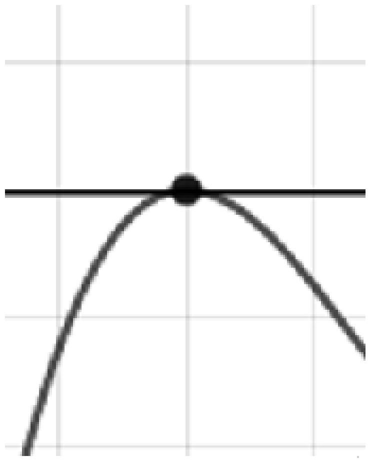
$$f(x) = 3(x + 8)^8(x - 8)^{11}(x - 7)^9(x + 7)^{13}$$

The solution is the graph below, which is option D.

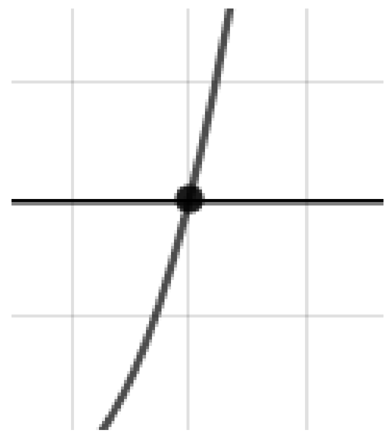




A.

B. 

C. 

D. 

E. None of the above.

General Comment: You will need to sketch the entire graph, then zoom in on the zero the question asks about.

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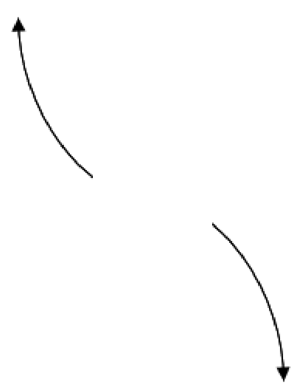
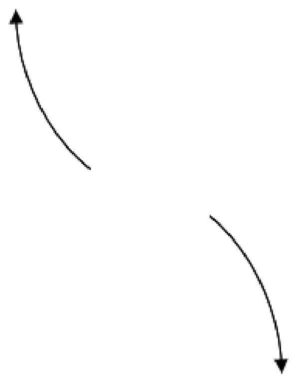
4. Describe the end behavior of the polynomial below.

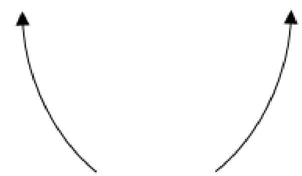
$$f(x) = -4(x+6)^4(x-6)^5(x+2)^5(x-2)^5$$

The solution is the graph below, which is option A.

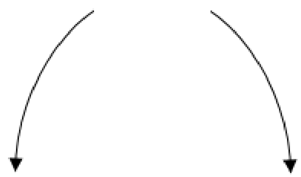




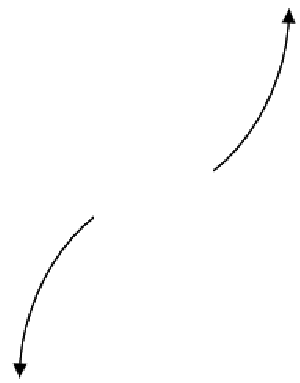
A.



C.



B.



D.

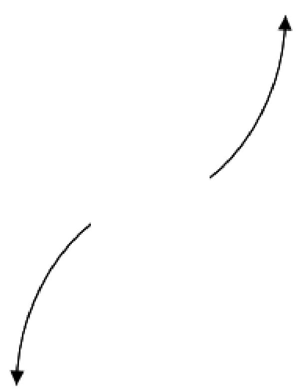
E. None of the above.

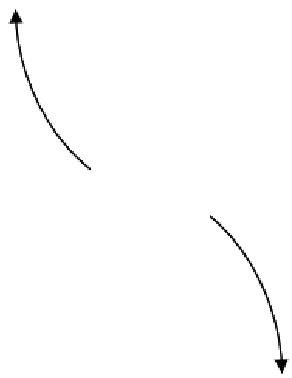
General Comment: Remember that end behavior is determined by the leading coefficient AND whether the **sum** of the multiplicities is positive or negative.

5. Describe the end behavior of the polynomial below.

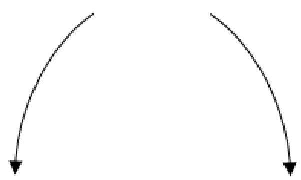
$$f(x) = 4(x+2)^5(x-2)^8(x+9)^3(x-9)^3$$

The solution is the graph below, which is option D.

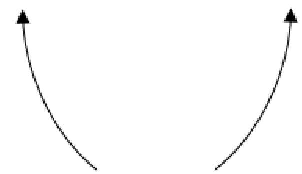




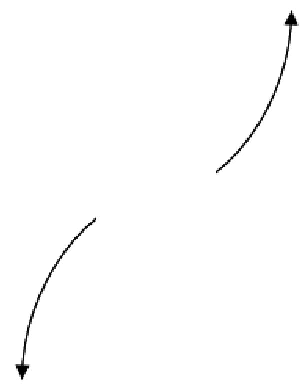
A.



B.



C.



D.

E. None of the above.

General Comment: Remember that end behavior is determined by the leading coefficient AND whether the **sum** of the multiplicities is positive or negative.

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6. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $x^3 + bx^2 + cx + d$.

$$-5 + 5i \text{ and } -1$$

The solution is $x^3 + 11x^2 + 60x + 50$, which is option B.

A. $b \in [-16, -10], c \in [59, 67],$ and $d \in [-58, -48]$

$x^3 - 11x^2 + 60x - 50$, which corresponds to multiplying out $(x - (-5 + 5i))(x - (-5 - 5i))(x - 1)$.

B. $b \in [4, 19], c \in [59, 67],$ and $d \in [46, 58]$

* $x^3 + 11x^2 + 60x + 50$, which is the correct option.

C. $b \in [-8, 6], c \in [-1, 13],$ and $d \in [3, 6]$

$x^3 + x^2 + 6x + 5$, which corresponds to multiplying out $(x + 5)(x + 1)$.

D. $b \in [-8, 6], c \in [-6, 3],$ and $d \in [-7, 3]$

$x^3 + x^2 - 4x - 5$, which corresponds to multiplying out $(x - 5)(x + 1)$.

E. None of the above.

This corresponds to making an unanticipated error or not understanding how to use nonreal complex numbers to create the lowest-degree polynomial. If you chose this and are not sure what you did wrong, please contact the coordinator for help.

General Comment: Remember that the conjugate of $a + bi$ is $a - bi$. Since these zeros always come in pairs, we need to multiply out $(x - (-5 + 5i))(x - (-5 - 5i))(x - (-1))$.

---

7. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $ax^3 + bx^2 + cx + d$.

$$\frac{-2}{5}, \frac{-3}{2}, \text{ and } \frac{1}{5}$$

The solution is $50x^3 + 85x^2 + 11x - 6$, which is option C.

A. $a \in [48, 62], b \in [44, 50], c \in [-44, -38], \text{ and } d \in [1, 10]$

$50x^3 + 45x^2 - 41x + 6$, which corresponds to multiplying out $(5x - 2)(2x + 3)(5x - 1)$.

B. $a \in [48, 62], b \in [-106, -98], c \in [42, 50], \text{ and } d \in [-8, 2]$

$50x^3 - 105x^2 + 49x - 6$, which corresponds to multiplying out $(5x - 2)(2x - 3)(5x - 1)$.

C. $a \in [48, 62], b \in [79, 88], c \in [7, 18], \text{ and } d \in [-8, 2]$

* $50x^3 + 85x^2 + 11x - 6$, which is the correct option.

D. $a \in [48, 62], b \in [79, 88], c \in [7, 18], \text{ and } d \in [1, 10]$

$50x^3 + 85x^2 + 11x + 6$, which corresponds to multiplying everything correctly except the constant term.

E. $a \in [48, 62], b \in [-85, -84], c \in [7, 18], \text{ and } d \in [1, 10]$

$50x^3 - 85x^2 + 11x + 6$, which corresponds to multiplying out $(5x - 2)(2x - 3)(5x + 1)$.

General Comment: To construct the lowest-degree polynomial, you want to multiply out $(5x + 2)(2x + 3)(5x - 1)$

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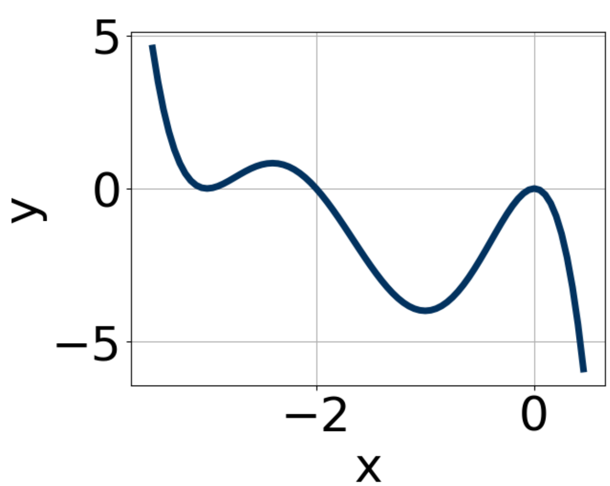
8. Which of the following equations *could* be of the graph presented below?



The solution is $-13x^8(x + 3)^{10}(x + 2)^5$, which is option D.

A. $14x^{10}(x + 3)^{10}(x + 2)^5$

This corresponds to the leading coefficient being the opposite value than it should be.

B. $18x^{10}(x+3)^4(x+2)^4$

The factor $(x+2)$ should have an odd power and the leading coefficient should be the opposite sign.

C. $-11x^9(x+3)^6(x+2)^5$

The factor x should have an even power.

D. $-13x^8(x+3)^{10}(x+2)^5$

* This is the correct option.

E. $-8x^{11}(x+3)^{10}(x+2)^{10}$

The factor x should have an even power and the factor $(x+2)$ should have an odd power.

General Comment: General Comments: Draw the x-axis to determine which zeros are touching (and so have even multiplicity) or cross (and have odd multiplicity).

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9. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $x^3 + bx^2 + cx + d$.

$$4 - 3i \text{ and } 3$$

The solution is $x^3 - 11x^2 + 49x - 75$, which is option B.

A. $b \in [9, 12], c \in [40, 52], \text{ and } d \in [74, 86]$

$x^3 + 11x^2 + 49x + 75$, which corresponds to multiplying out $(x-(4-3i))(x-(4+3i))(x+3)$.

B. $b \in [-14, -5], c \in [40, 52], \text{ and } d \in [-77, -72]$

* $x^3 - 11x^2 + 49x - 75$, which is the correct option.

C. $b \in [0, 3], c \in [0, 5], \text{ and } d \in [-9, -8]$

$x^3 + x^2 - 9$, which corresponds to multiplying out $(x+3)(x-3)$.

D. $b \in [0, 3], c \in [-10, -6], \text{ and } d \in [7, 16]$

$x^3 + x^2 - 7x + 12$, which corresponds to multiplying out $(x-4)(x-3)$.

E. None of the above.

This corresponds to making an unanticipated error or not understanding how to use nonreal complex numbers to create the lowest-degree polynomial. If you chose this and are not sure what you did wrong, please contact the coordinator for help.

General Comment: Remember that the conjugate of $a + bi$ is $a - bi$. Since these zeros always come in pairs, we need to multiply out $(x-(4-3i))(x-(4+3i))(x-(3))$.

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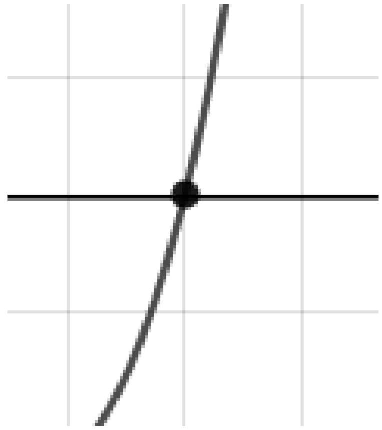
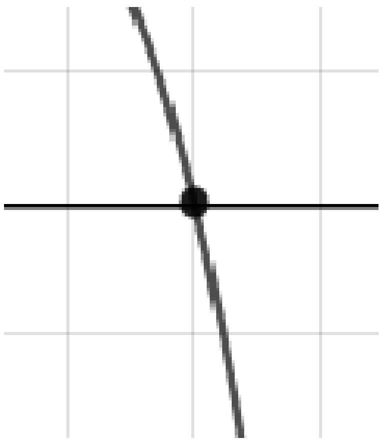
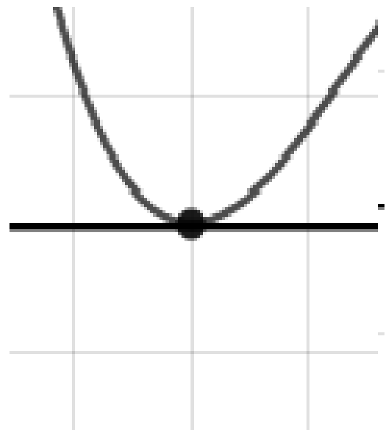
10. Describe the zero behavior of the zero $x = 3$ of the polynomial below.

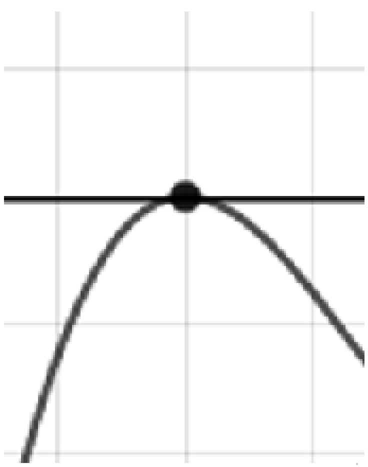
$$f(x) = 3(x-3)^5(x+3)^{10}(x+8)^5(x-8)^6$$

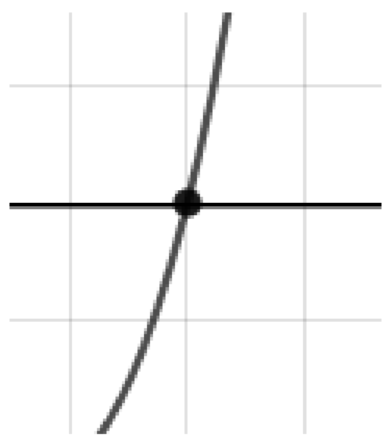
The solution is the graph below, which is option D.



A. 

C. 

B. 

D. 

E. None of the above.

General Comment: You will need to sketch the entire graph, then zoom in on the zero the question asks about.